advantage by advanced students of geology and geography, the educational section is of most use to a different circle of readers. The author's criticisms of teachers and text-books would probably have been better confined to a work expressly for teachers, as it is not always good for the intellectual discipline of students to have their often scanty faith in their instructors still further reduced. Geographical education should, moreover, proceed on such different lines in countries in different stages of development, that its discussion is of more local interest than that of physical problems, which are of universal application. The educational essays should, however, be read by all geographical teachers, who must benefit from their high ideals and valuable practical suggestions.

The fourteen physiographic essays in this volume show the development of Prof. Davis's views on denudation. The earliest in date deals with the rivers of Pennsylvania and New Jersey, and led to his well-known classification of rivers according to their relation to the original slope of the land. The wearing away of the land to a plain sloping slowly to the sea is brought out in two papers on the peneplain and on base level, and they lead to the geographical cycle due to the interaction between uplift and denudation. The course of the geographical cycle in an arid climate is discussed in a memoir first published by Prof. Davis in 1905. Among the other papers included are those on glacial erosion in France, Switzerland, and Norway (1900), on the sculpture of mountains by glaciers (1905), on the mountain ranges of the Great Basin, and on the remarkable instances of river capture in the valleys of the Seine, Meuse, and Moselle.

The most striking feature in Prof. Davis's geographical writings is his devotion to the deductive method. He rejects emphatically the view that geography is to be advanced chiefly "by observation, description, and generalisation." To use those methods only is, he says, to walk on one foot. He claims that invention and deduction are as necessary to geography as to any other science. Many of his valuable results are due to his keen insight and not to his method, which cannot be unduly adopted without altering the position of geography in the circle of sciences. The very name geography implies that the subject is descriptive rather than deductive, although some deduction is required by all schools of geographers. But it has hitherto been found convenient to limit geographical work mainly to observation, description, and generalisation, restricting advanced deductive methods to the special problem of geography—the relation of the earth to man. The subject-matter of geography is so enormous that it seems reasonable as well as convenient that there should be a special science and societies devoted to the mapping and description of the earth as it is, leaving its evolution and explanation to other sciences.

Geology, on the other hand, is a "logos," not a "graphe"! and hence requires a more intimate connection of observation and inference than does physical geography. Much that Prof. Davis calls geography has been generally regarded as geology. The distinction that has been so long established and has worked so well in this country, is shown by Prof. Davis himself to have been accepted also in America; for he is professor of geology at Harvard and not of geography. Most of his physiographic essays are quite appropriate to a geological school, and they have been more read in this country by geologists than by geographers. Four of them were published in geological and six in geographical journals.

Prof. Davis, however, regards geology and geography as essentially the same. "They are parts of one great subject," he says (p. 196). "It is a misfortune that we have no English word to include both geography and geology" (p. 198). "To set them apart" he describes as an "obsolescent system" (p. 204). Prof. Davis, moreover, restricts geology to a minor section of the joint subject; he regards it (p. 37) as the sequence of events in the earth's history, and he regrets that such questions as rock weathering are not included in geography. The geographer must, of course, know some of the elementary facts of geology, as he does of meteorology and physics; but he has so many difficult problems connected with man on the earth that he may conveniently refer the study of complicated physical causes to astronomy, meteorology and geology. The abandonment of the conventional boundary between geography and geology would probably prove ultimately detrimental to both sciences.

The classification of some of Prof. Davis's memoirs as geology instead of geography does not lessen their high value. Probably no living writer has done so much to improve the interpretation of denudation. His deductive method and his keen insight have enabled him in studying the history of river systems to unravel confused tangles of facts, and by skipping intermediate phases to go back to stages of which most geologists thought that no traces could be surely recognised in existing geography. The two chapters on glacial erosion illustrate the advantages and the dangers of the deductive method; for according to some geologists, it has led Prof. Davis to attach undue weight to certain striking features of mountain form, and to overlook features which must be included in a complete explanation. Prof. Bonney's presidential address to the British Association has brought the controversy on glacial erosion to a head. It may be hoped that the authoritative and masterly statements on both sides will lead to an agreement as to the main facts, but no settlement can be expected until the arguments of those who limit the efficacy of glaciers as eroding agents have been directly answered. J. W. G.

TECHNICAL ORGANIC ANALYSIS.

Allen's Commercial Organic Analysis. Vol. iii., Hydrocarbons, Petroleum, Aromatic Acids, Explosives. Edited by W. A. Davis and Samuel S. Sadtler. Fourth edition, entirely re-written. Pp. x+635. (London: J. and A. Churchill, 1910.) Price 21*s.* net.

THE original "Allen's Commercial Organic Analysis" had established a place of eminence in all analytical and technological laboratories and was a book—it may be said still is a book—of every-day reference. At the same time the trend of modern

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chemistry and the rapid advances which are taking place owing to chemical research and improved methods prevent any book, however well up-to-date on its publication, from holding its place unless it is continually revised. In this respect Allen's book required revision along with other reference books of a similar nature. The work has now been taken up by new editors, and when this is the case one naturally scrutinises somewhat carefully the new edition to ascertain whether real improvements have been made. It must be said at once that the revision of another man's work is much more difficult than to start to write a book *de novo*, and the attempts which one naturally makes to leave in paragraphs untouched which were written ten years ago and incorporate them with new material, the reverse of easy.

The editing is being jointly carried out by Mr. W. A. Davis, of London, and Mr. Samuel S. Sadtler, of America. As British and American methods of analysis are not always quite similar this editorship strikes one as being a wise, but at the same time rather difficult arrangement. The individual sections are, as is always the case in reference books of this nature, written by different collaborators. In this volume Dr. F. C. Garrett deals with hydrocarbons of the aliphatic, olefine, and acetylene series and of tars. This section, also under acetylene, includes the valuation of calcium carbide and a reference to the method of Lunge and Cedercreutz in the *Zeitschrift für anorganische Chemie* is given. The abstract of the method, however, is hardly sufficiently full. Surely such books as the one under review are written to enable the reader to carry out estimations without having to refer to the original literature. We do not mean that all processes for the analysis of a given substance should be given, but surely one—the one the writer of the section considers the best—should be set out in detail. The others need be only briefly referred to, or the references to the original literature given.

The processes of tar analysis differ so considerably in detail in different works and with the various processes of distillation—that is to say, high- or low-temperature distillation—and the quality of the coal, that probably the author is right in giving a more or less general survey of the subject. We think, however, that the tars produced from the water-gas process and coke-oven tar might have been described in greater detail.

Mr. Sadtler has compiled the section on bitumens, and treats of the distillation of petroleum, ozokerite, asphalt, petroleum and shale products, cyclic hydrocarbons from coal tar, coal tar naphtha, and other similar products. This section is fairly full, and occupies 223 pages, that is to say, rather more than one-third of the book. On the whole the section on petroleum oils is very good. The subject is a big one, but most of the ground is covered in a quite satisfactory manner. One can see that the author is largely writing at first hand, and although he quotes many authorities, he usually lets the reader know which he considers is the most trustworthy method to adopt.

Mr. Sadtler is also responsible for anthracene and its associates and for the phenols. The latter section is naturally of great importance owing to the extended employment of phenols and phenolic derivatives for disinfecting and antiseptic purposes. The subject is treated in a broad and comprehensive manner, and deals not only with phenols and creosotes from coal tar, but also from various other sources, such as blast-furnace tar, shale-oil tar, and so on.

Mr. W. A. Davis is responsible for the sections on naphthalene and its derivatives, and phthalic acid and phthaleins, Mr. W. P. Dreaper for gallic acid and its allies, and Mr. Edward Horton for the aromatic acids.

Taken as a whole, the volume has been well brought up-to-date, and will, we think, still maintain its place as an invaluable book of reference in the laboratory, particularly of the technical chemist. Its one fault to our mind is that the authors are apt to be rather too discursive and rather disinclined to put the analytical particulars in a concrete form. The book professes to deal with commercial organic analysis, but sometimes one has to read a very long way before coming to any analytical facts. Of course, it is of great assistance to read all about the properties of the substance, but the exact analytical methods are of the utmost importance.

By these remarks we do not wish to detract from the merits of a most valuable work, but to point out where the succeeding volumes might, in our opinion, be strengthened and made even more valuable.

F. M. P.

TASMANIAN SKULLS.

Dioptrographic Tracings in Four Normal of Fifty-two Tasmanian Crania. By Prof. R. J. A. Berry and A. W. D. Robertson. (Melbourne, Transactions of the Royal Society of Victoria, vol. v., part i.) (Melbourne: Kemp, 1909.)

WITH the death of "Lalla Rhook" in 1876 one of the most interesting of human races passed out of existence. "When we reflect," write the authors of this atlas, "that the Tasmanian aboriginal carried into our own times the primitive culture of Palæolithic man and many of the structural peculiarities of *Homo neanderthalensis* we realise, the scientific importance of the study of Tasmanian remains." They have made by far the largest contribution to the material on which our conception of the Tasmanian race must be based, and made it at a most unexpected period. In his well-known monograph on the Tasmanian race, published two years ago, Sir William Turner gave a detailed list of all the skulls then known, seventy-nine in number, and was of opinion that further additions were unlikely. The authors of this atlas have been successful in finding forty-two hitherto unknown specimens, thirty-three of which they discovered in various private and museum collections in Tasmania, while nine they unearthed from a native burial ground. In preparing and publishing an atlas which contains 212 accurate tracings of these crania, the authors had two objects in view: they wished to make the material thus discovered available for the study of anthropologists throughout the world; they also wished to secure a permanent record of crania which, being chiefly in the hands of private owners, are liable to be lost or destroyed.

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